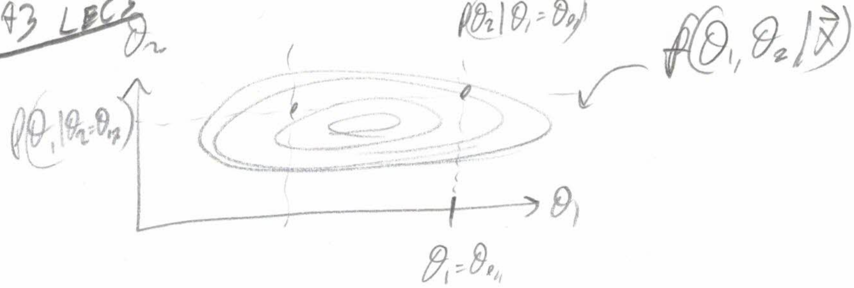


Gibbs Sampling Illustration

If we cannot sample from $p(\theta_j|\theta_{-j},\vec{x})$, can we approximate it? Or at least move around the space effectively? Yes.

Consider (I) $q(\theta_{j,t-1},\phi)$, the "proposal distr" with PDF f_q which proposes $\theta^*_{j,t}$ e.g. $q(\theta_{j,t-1},\phi)=N(\theta_{j,t-1},1)$.

(II) Then calculate:

$$r := \frac{\dfrac{p(\theta_{1,t},\ldots,\theta^*_{j,t},\theta_{j+1,t-1},\ldots,\theta_{K,t-1})}{f_q(\theta^*_{j,t};\theta_{j,t-1},\phi)}}{\dfrac{p(\theta_{1,t},\ldots,\theta_{j,t-1},\theta_{j+1,t-1},\ldots,\theta_{K,t-1})}{f_q(\theta_{j,t-1};\theta^*_{j,t},\phi)}}$$

"prob of transitioning from $\theta_{j,t-1}\to\theta^*_{j,t}$"

prob of transitioning from $\theta^*_{j,t}\to\theta_{j,t-1}$

"Metropolis Ratio"

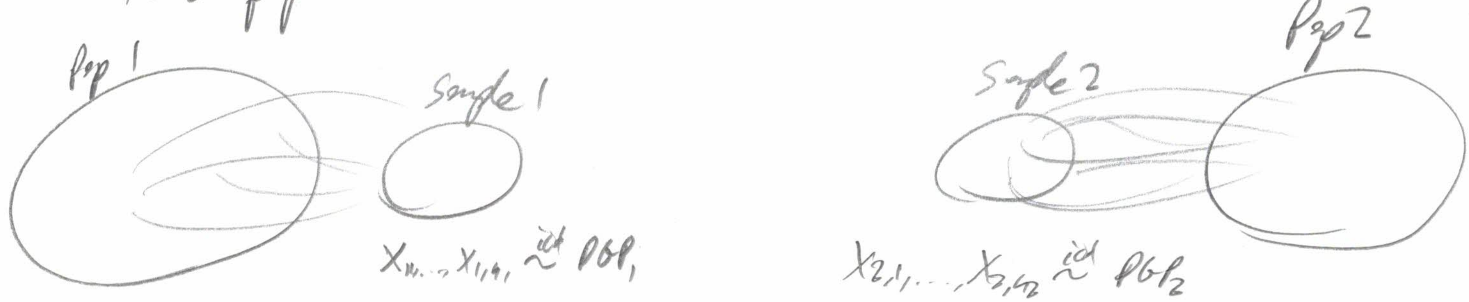
If $f_q(\theta^*_{j,t};\theta_{j,t-1},\phi)=f(\theta_{j-1,t};\theta^*_{j,t},\phi)$, r simplifies and is called the Hastings Ratio.

(III) Sample u from $U(0,1)$. If $u\le r$, then accept $\theta^*_{j,t}$ otherwise return $\theta_{j,t-1}$ and chain doesn't move.

Done with Bayesian... for now...

Back to the frequentist paradigm...

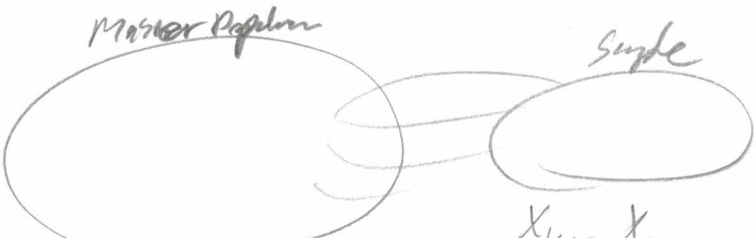
Two populations



$X_{1,1},\ldots,X_{1,n_1} \stackrel{iid}{\sim} DGP_1$ $\quad$ $X_{2,1},\ldots,X_{2,n_2} \stackrel{iid}{\sim} DGP_2$

$$H_a: DGP_1 \neq DGP_2 \quad , \quad H_0: DGP_1 = DGP_2 = DGP$$

We previously talked about the 2-sample K-S test. Here's a new test. Under H_0, there's no difference between the two pop's. Remember the $\hat{\theta}$ for the one sample prop test?



$X_1,\ldots,X_{n_1+n_2} \stackrel{iid}{\sim} DGP$ where $n = n_1 + n_2$

Thus, there should be no difference if we divide the sample into two subsets: one size n_1, the other size n_2. Let the subset be called "b". Let $I_{b,1}$ be indices of subset 1 and $I_{b,2}$ be indices of subset 2.
and then compare any test statistic between the two groups. e.g.

(a) $$\hat{\theta}_b := \bar{X}_{b,1} - \bar{X}_{b,2} = \frac{1}{n_1}\sum_{i \in I_{b,1}} x_i - \frac{1}{n_2}\sum_{i \in I_{b,2}} x_i$$

(b) $$\hat{\theta}_b := Med_{b,1} - Med_{b,2} = Med\left[\{x_i : i \in I_{b,1}\}\right] - Med\left[\{x_i : i \in I_{b,2}\}\right]$$